



CHROMOSOME NUMBERS IN *HIERACIUM* (ASTERACEAE) FROM CENTRAL AND SOUTHEASTERN EUROPE IV

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Chromosome numbers for 15 taxa of *Hieracium* L. s.str. from Bulgaria, Greece, Macedonia, Poland, Romania and Slovakia are given and their metaphase plates are illustrated. Chromosome numbers are published for the first time for *H. vagneri* Pax s.str. ($2n = 4x = 36$), *H. wiesbaurianum* subsp. *herculanum* Zahn ($2n = 4x = 36$), *H. wiesbaurianum* subsp. *kelainephes* Nyár. & Zahn ($2n = 3x = 27$), as well as for two undescribed species of hybrid origin between *H. umbellatum* L. and *H. wiesbaurianum* s.lat. ($2n = 3x = 27$), and between *H. sparsum* Friv. and *H. schmidtii* s.lat. ($2n = 3x = 27$), and for three undescribed species of the *H. djimilense* agg. ($2n = 3x = 27$), *H. heldreichii* agg. ($2n = 3x = 27$), and *H. sparsum* agg. ($2n = 3x = 27$). Furthermore, the chromosome numbers of two undescribed species of hybrid origin between *H. umbellatum* L. and *H. wiesbaurianum* s.lat. ($2n = 3x = 27$), and between *H. sparsum* Friv. and *H. schmidtii* s.lat. ($2n = 3x = 27$) are given. A new, tetraploid chromosome number is given for *H. barbatum* Tausch from the northernmost locality of the species in Europe.

Keywords: Asteraceae, chromosome number, Europe, *Hieracium*, karyotype

INTRODUCTION

This paper continues a series on the karyology of *Hieracium* L. in Central and Southeastern Europe conducted at the Department of Plant Cytology and Embryology of the Jagiellonian University (Musiał and Szelać, 2015; Musiał et al., 2016, 2017). Knowledge of the ploidy level, which in *Hieracium* s.str. indicates the mode of reproduction, is of particular interest in understanding taxonomic and phylogenetic relationships within the genus.

We are presenting here the chromosome numbers for 15 taxa from 19 populations in Bulgaria, Macedonia, Poland, Romania and Slovakia, including two undescribed species of hybrid origin between *H. umbellatum* L. and *H. wiesbaurianum* s.lat., and *H. sparsum* Friv. and *H. schmidtii* s.lat., as well as three undescribed species of the *H. djimilense*, *H. heldreichii* and *H. sparsum* aggregates.

MATERIAL AND METHODS

The seeds for cytological investigations were collected by ZS from plants in nature or in an experimental garden, and germinated on moistened filter paper in Petri dishes. The karyological analysis was performed by KM and AJ according to Marciniuk et al. (2012) with some modifications applied in the later studies (Wolanin and Musiał, 2017). The voucher specimens of the analysed taxa are deposited in KRAM.

RESULTS AND DISCUSSION

Hieracium barbatum Tausch; $2n = 4x = 36$
(Fig. 1a)

Poland, Western Carpathians, Pogórze Wielickie foothills, Osieczany village near Myślenice, 300 m a.s.l., *Tilio-Carpinetum* forest margin.

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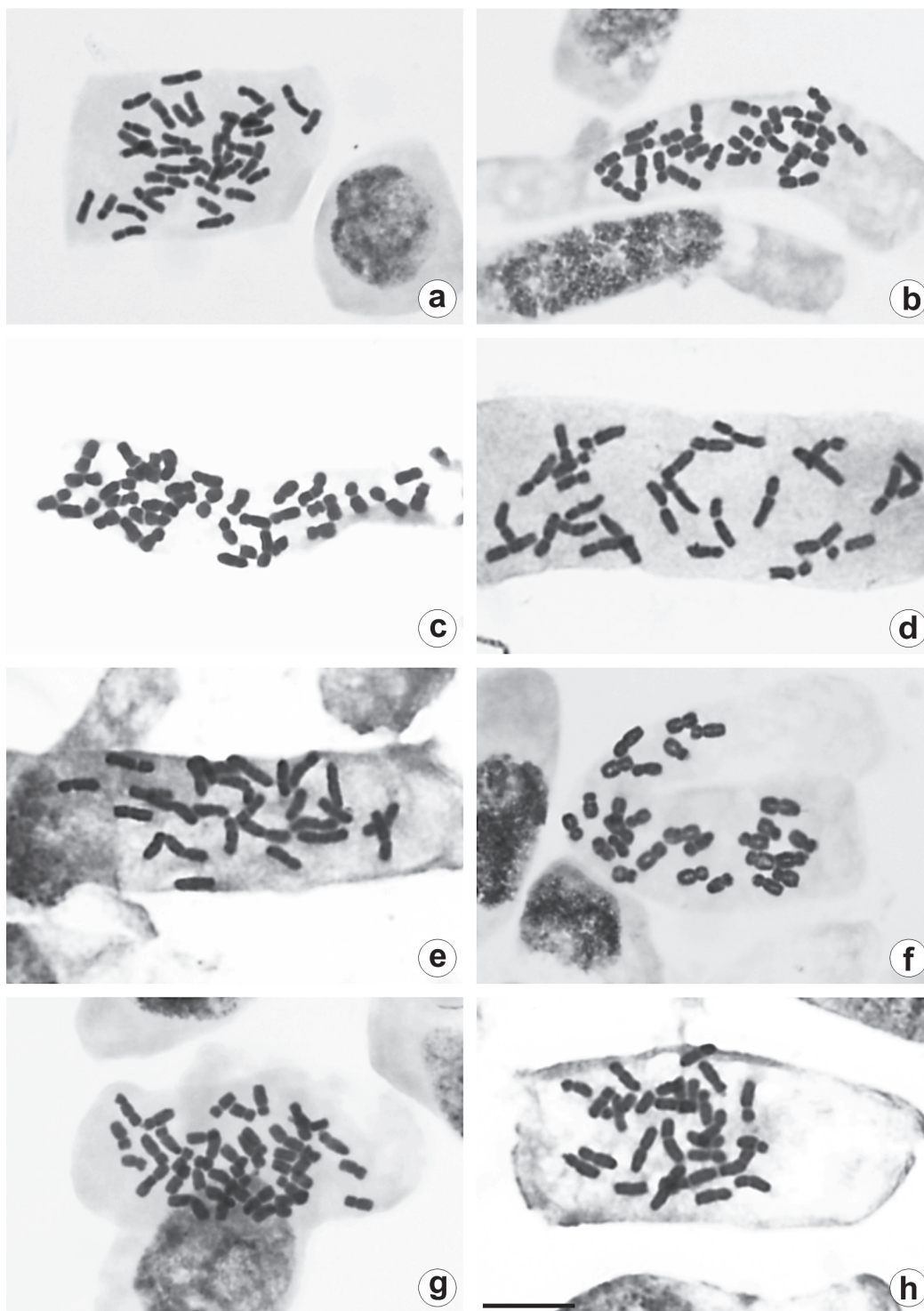


Fig. 1. Metaphase plates of: (a) *Hieracium barbatum* $2n=4x=36$, (b) *H. bifidum* s.lat. $2n=3x=27$, (c) *H. bifidum* s.lat. $2n=4x=36$, (d) *H. bohatschianum* agg. $2n=3x=27$, (e) *H. bupleuroides* $2n=3x=27$, (f) *H. djimilense* agg. $2n=3x=27$, (g) *H. fritzei* agg. $2n=4x=36$, (h) *H. heldreichii* agg. $2n=3x=27$. Scale bar in h = 10 μm and refers to all figures.

This is the first tetraploid chromosome number for *H. barbatum*. Previously plants from the same population in Osieczany were found to be triploid (Szelag and Vladimirov 2005). *Hieracium barbatum* belongs to the *H. racemosum* agg.; its localities in Poland are among the northernmost for the whole *H. racemosum* agg.

Hieracium bifidum s.lat.; $2n = 3x = 27$
and $2n = 4x = 36$ (Fig. 1b and c)

1. Poland, Wyżyna Krakowsko-Częstochowska upland, Brama Bolechowicka hill, 370 m a.s.l., calcareous rocks with *Festuca pallens*, $2n = 3x = 27$.
2. Poland, Wyżyna Krakowsko-Częstochowska upland, Prądnik river valley, Ciche hill near Ojców, 340 m a.s.l., calcareous rocks with *Festuca pallens* along a road, $2n = 3x = 27$.
3. Poland, Wyżyna Krakowsko-Częstochowska upland, Góra Sokola hill ca. 2 km south of Olsztyn village, 320 m a.s.l., calcareous rocks and scree in *Fagus sylvatica* forest (plants with glabrous leaves) (Fig. 1b), $2n = 3x = 27$.
4. Romania, Apuseni Mts., Cheile Turzii gorge, 470 m a.s.l., calcareous crevices along a tourist path in the canyon, $2n = 3x = 27$.
5. Poland, Wyżyna Krakowsko-Częstochowska upland, Góra Zborów hill, 360 m a.s.l., calcareous scree with *Festuca pallens* (plants with glabrous leaves), $2n = 4x = 36$ (Fig. 1c).

Our chromosome numbers well match those previously published for *H. bifidum* s.lat. from Poland and Romania, and triploids predominate in Poland (Mráz and Szelag, 2004; Ilnicki and Szelag, 2011; Musiał et al., 2016, 2017).

Hieracium bohatschianum agg.; $2n = 3x = 27$
(Fig. 1d)

Bulgaria, Rila Mts., Malyovitsa tourist complex, 1700 m a.s.l., *Picea abies* forest margin on siliceous slope.

The analyzed plants represent a new species of the morphological formula *H. sparsum* > *H. schmidtii* and will be the subject of ongoing studies to be presented separately.

Hieracium bupleuroides C.C.Gmel.; $2n = 3x = 27$
(Fig. 1e)

Slovakia, Western Carpathians, Slovenský raj Mts., Stratená village, 820 m a.s.l., calcareous rocks ca. 50 m east of a road tunnel.

Our data confirm the chromosome number published from Slovakia (Májovský, 1970; Chrtek et al., 2004).

Hieracium djimilense agg.; $2n = 3x = 27$ (Fig. 1f)
Bulgaria, Rila Mts., Rilska reka valley, 1730 m a.s.l., open grassy places in *Picea abies* communities on granite.

The analyzed plants represent a previously undescribed species of the morphological formula *H. sparsum* < *H. prenanthoides*, morphologically similar to *H. djimilense* subsp. *nigridorsum* (Urum. & Zahn) Zahn, and known also from the Pirin Mts. (Szelag and Vladimirov, in prep.). This chromosome number confirms the number recognized in plants from the Pirin Mts. (Musiał et al., 2017).

Hieracium fritzei agg.; $2n = 4x = 36$ (Fig. 1g)

Romania, Eastern Carpathians, Ciucas Mts., Mt. Muntele Roșu, 1700 m a.s.l., grassy slope with *Rhododendron myrtifolium*.

The analyzed plants belong to an undescribed species which will be the subject of ongoing studies to be presented separately.

Hieracium heldreichii agg. sensu Szelag (2018);
 $2n = 3x = 27$ (Fig. 1h)

Bulgaria, Rila Mts., between Sapareva Banya and Panichishte, 940 m a.s.l., siliceous rocks on *Pinus sylvestris* forest margin along a road.

The analyzed plants represent an undescribed species, morphologically similar to *H. ossaeum* Freyn (Szelag and Vladimirov, in prep.).

Hieracium jankae R. Uechtr.; $2n = 3x = 27$
(Fig. 2a)

Romania, Banat Mts., ca. 0.5 km east of Mt. Trescovaț, 570 m a.s.l., eroded slope in the *Quercus pubescens* forest on silicate.

Our data confirm the chromosome number published by Mráz and Szelag (2004) from the *locus classicus* of the species.

Hieracium olympicum Boiss.; $2n = 3x = 27$
(Fig. 2b)

Greece, Vrontous Mts., along a road to Mt. Leilias refuge, 1480 m a.s.l., rocky slope on granite in a *Pinus sylvestris* forest.

The involucre bracts of the analyzed plants are covered by stellate hairs, without simple trichomes. The same ploidy level was found in plants originating from Bulgaria (Vladimirov and Szelag, 2001; Chrtek et al., 2007).

Hieracium schmidtii Tausch; $2n = 4x = 36$
(Fig. 2c)

Poland, Central Sudetes, Lubawka, along a road to Chelmsko Śląskie village, 550 m a.s.l., andesite rock with *Festuca pallens*.

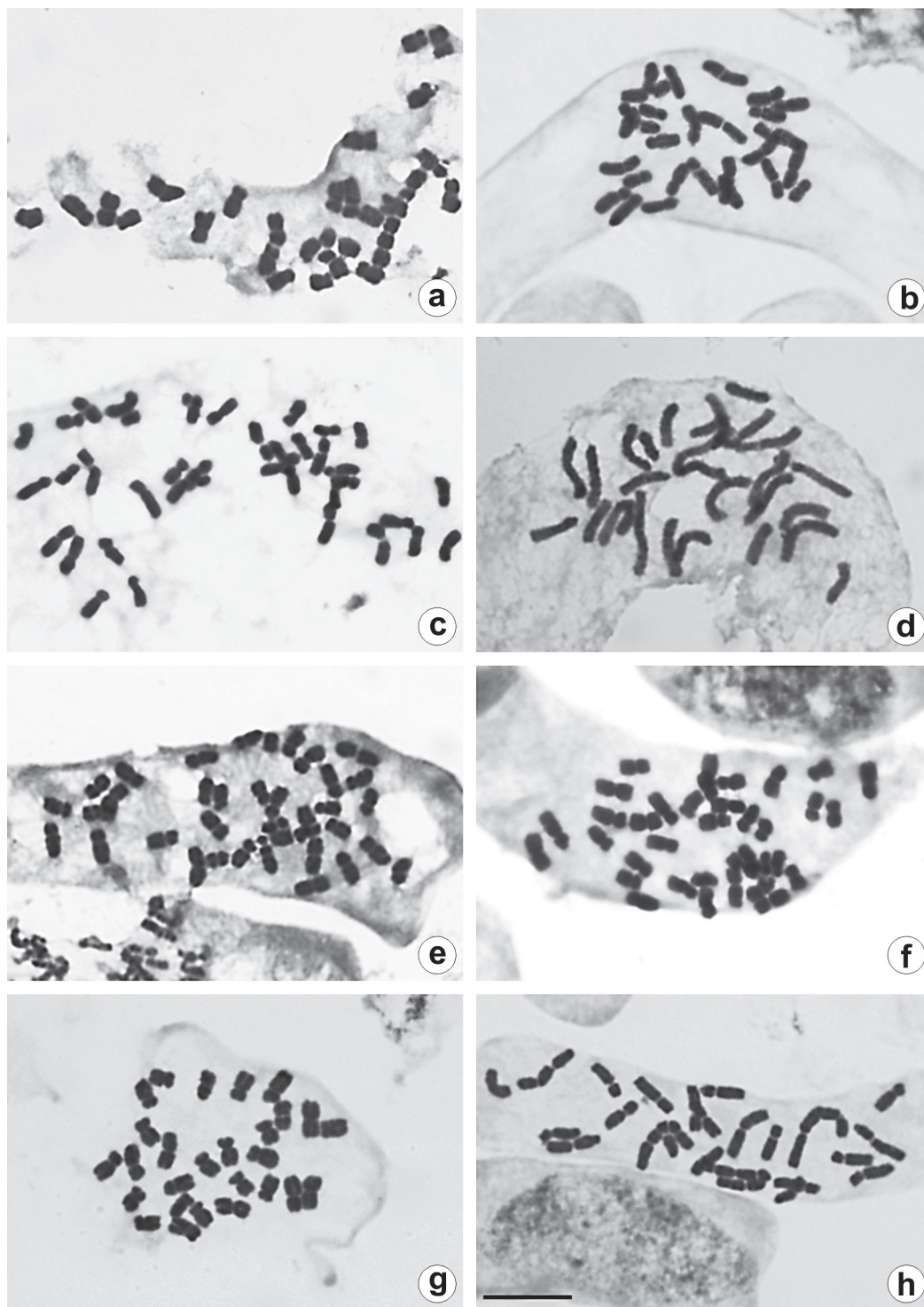


Fig. 2. Metaphase plates of: (a) *Hieracium jankae* $2n=3x=27$, (b) *H. olympicum* $2n=3x=27$, (c) *H. schmidtii* $2n=4x=36$, (d) *H. sparsum* s.lat. $2n=3x=27$, (e) *H. vagneri* $2n=4x=36$, (f) *H. wiesbaurianum* subsp. *herculanum* $2n=4x=36$, (g) *H. wiesbaurianum* subsp. *kelainephes* $2n=3x=27$, (h) *H. Hieracium* sp. 'Trescovat' $2n=3x=27$. Scale bar in h = 10 μ m and refers to all figures.

Triploid chromosome numbers were previously published from the Karkonosze Mts. (Chrtek, 1996; Musiał et al., 2017).

Hieracium sparsum s.lat.; $2n = 3x = 27$ (Fig. 2d) Macedonia, Baba planina Mts., Mt. Kozji Kamen, 2070 m a.s.l., subalpine grassland on schist. The analyzed plants are similar to *H. sparsum* subsp. *naegelianiforme* Behr & Zahn, but differ in their tubular florets, and represent a new species (Szeląg, in prep.).

Hieracium vagneri Pax; $2n = 4x = 36$ (Fig. 2e) Romania, Eastern Carpathians, Gutâi Mts., Mt. Gutâi, 1430 m a.s.l., on trachytic rocks (*locus classicus* of the species).

This is the first chromosome number for *H. vagneri* s.str. The plants belonging to *H. vagneri* s.lat. from the Polish part of the Eastern Carpathians were also found to be tetraploid (Musiał and Szeląg, 2015).

Hieracium wiesbaurianum subsp. *herculanum* Zahn; $2n = 4x = 36$ (Fig. 2f) Romania, Banat Mts., Mt. Trescovaț, 680 m a.s.l., *Carpinus orientalis*-*Pinus nigra* forest on a summit on rhyolite.

This is the first chromosome number for this taxon endemic to Romania.

Hieracium wiesbaurianum subsp. *kelainephes* Nyár. & Zahn; $2n = 3x = 27$ (Fig. 2g) Romania, Apuseni Mts., Cheile Turzii gorge, 470 m a.s.l., calcareous crevices along a tourist path in the canyon (*locus classicus* of the species).

This is the first chromosome number for this taxon endemic to Romania.

Hieracium sp. 'Trescovaț'; $2n = 3x = 27$ (Fig. 2h) Romania, Banat Mts., S slope of Mt. Trescovaț, 200 m a.s.l., eroded slope in a *Quercus pubescens*-*Carpinus orientalis* forest on silicate along a touristic path from Svinița village to Mt. Trescovaț.

A new, undescribed species of presumably hybrid origin between *H. umbellatum* L. and probably *H. wiesbaurianum* s.lat.

AUTHORS' CONTRIBUTION

KM and AJ – karyological analysis, preparation of figures and interpretation of results; ZS – idea, sampling and drafting of manuscript. The authors have declared that there is no conflict of interest.

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